STUDY OF DELIVERY DISTRIBUTION IN THE CENTRAL AREA BY TOKYO METROPOLITAN FREIGHT SURVEY

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In this Paper, the outline of the result of local delivery survey was executed in Tokyo Metropolitan Region, and the various measures for improvement of the delivery was by the result of Tokyo Metropolitan Freight Survey. Through quantitative analysis of the logistics survey, It is apparent that there is the relation between deliveries and the traffic problem. The mechanism of the problems in the area traffic caused by the delivery in the TMR was quantitatively clarified with the analysis of the local delivery survey. The measures together at each of three main activities are;

1) Measures to reduce the amount of delivery vehicle traffic
2) Measures to secure parking for delivery vehicles on streets
3) Measures to improve the transport of goods between delivery vehicles and their final destinations.

INTRODUCTION

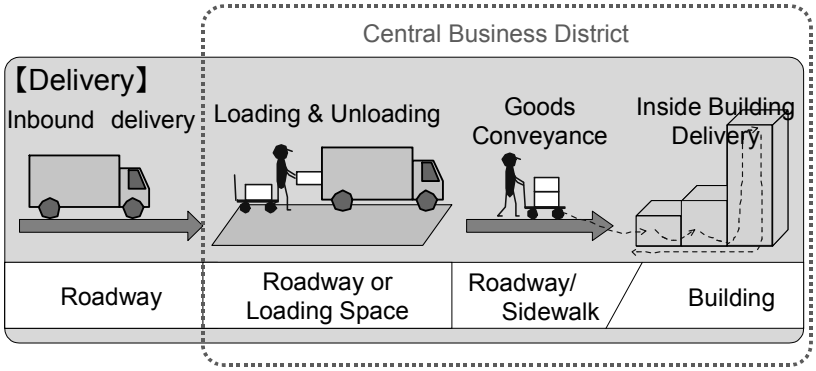
The delivery process is an important link in the logistics chain between producers and consumers. Hence, improving the delivery system plays a vital role in helping to streamline the entire distribution process. Likewise, because deliveries are mostly made in the Central Business District (CBD), measures that improve the delivery system not only help streamline the distribution process, but also help spur commerce and improve traffic flows. Furthermore, with parking law enforcement becoming stricter in Japan, it is all the more important to find ways to improve goods loading and unloading within the CBD.

In 2003, the 4th Tokyo Metropolitan Region (TMR) Goods Flow Survey was conducted consisting of a number of goods movement surveys including those that deal with local deliveries. This paper provides a summary of the Local Delivery Surveys conducted in the TMR, and based on the results of the surveys, recommends measures which could help improve the delivery system.

DELIVERY SYSTEM PROBLEMS

Delivery System Structure

The delivery activity is that part of the distribution system in which goods are brought to their final destinations, mostly at shops and offices. It specifically deals with the period when a delivery vehicle enters a district to perform pick-up or delivery until the time it leaves the area. The delivery process can be classified into three main activities. They are 1) pick-up and/or delivery, 2) parking, and loading and unloading, and 3) goods conveyance back and forth from/to the parked truck to/from the final destination. （Figure 1）

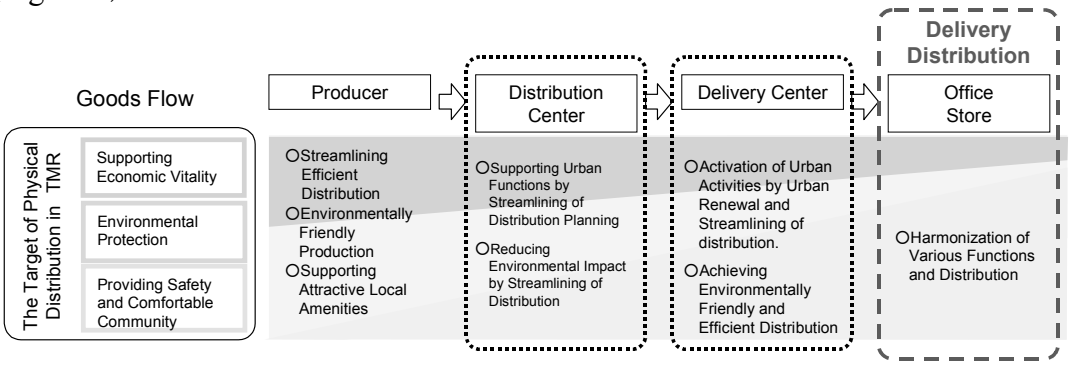


Source: Guideline of delivery distribution on TRM(2006)

Figure 1. Delivery related activities

Distribution problems and their perception depend on various factors such as whether goods are transported along a major artery and where a facility is located, among others.

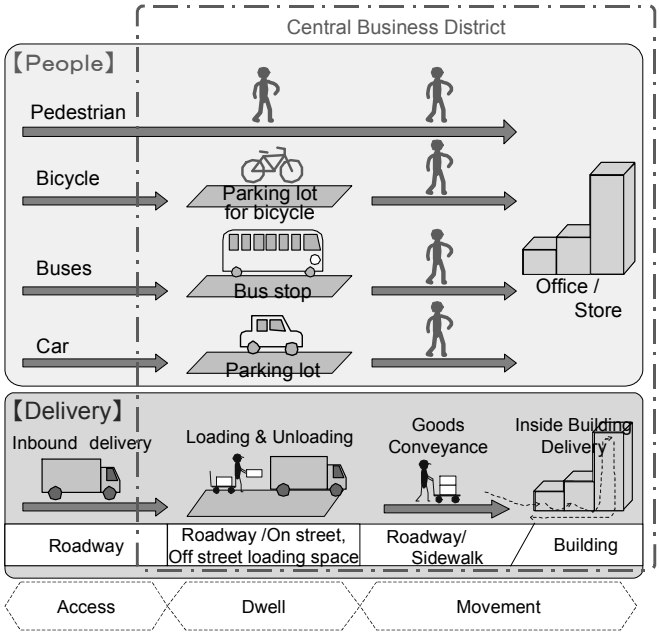
Concerned people in major cities hope for a distribution system that can support economic development, is kind to the environment, and can provide for a safe and comfortable community. In the case of deliveries, it is with regards to the provision for a safe and comfortable community that people feel the greatest need for improvement. （Figure 2）



Source: Guideline of delivery distribution on TRM(2006)

Figure 2. The delivery activity within the entire distribution process

Deliveries occur over and over again at CBDs to support its various functions such as business, commercial, cultural, and entertainment activities. In addition to being vital activities in the distribution chain, they also often occur at places where people converge in large numbers.



Source: Guideline of delivery distribution on TRM(2006)

Figure 3. Relationship of people and goods in the CBD

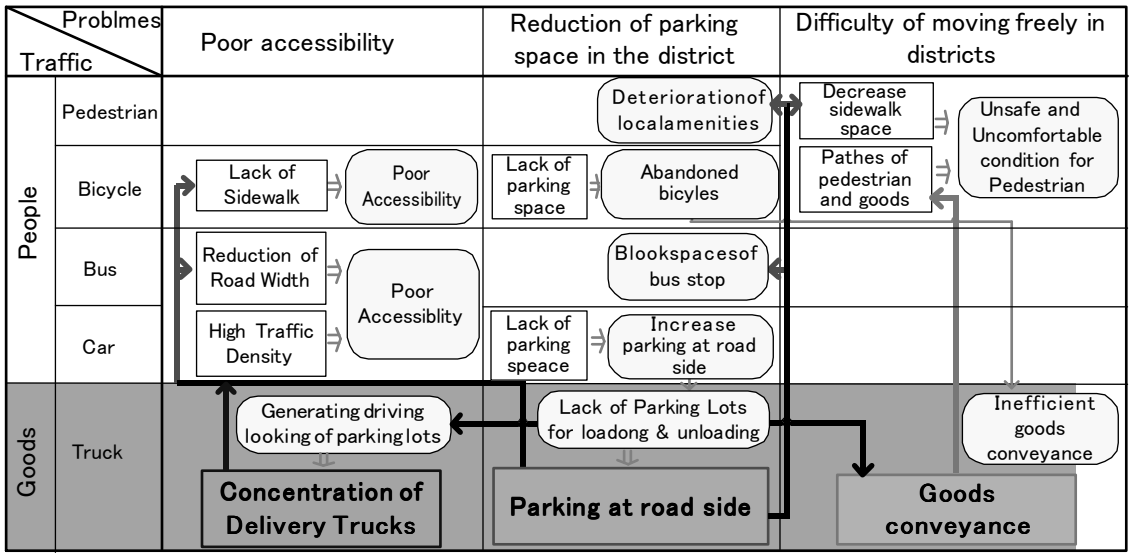
Figure 3 shows traffic action in CBD. People frequently come to the CBD by car and then leave their cars at parking lots or on the street while they walk around in spaces designed for pedestrian traffic. Goods, on the other hand, are delivered to the CBD by

delivery trucks, which perform their loading and unloading at designated loading zones or parking spaces, or on the street in cases when there are no available parking spaces for loading and unloading. The goods are then basically delivered by hand using pedestrian spaces. The delivery of goods follows the movement of people, and thus, it can be said that people and goods generally share the same space resulting in congestion problems.

Delivery Related Problems

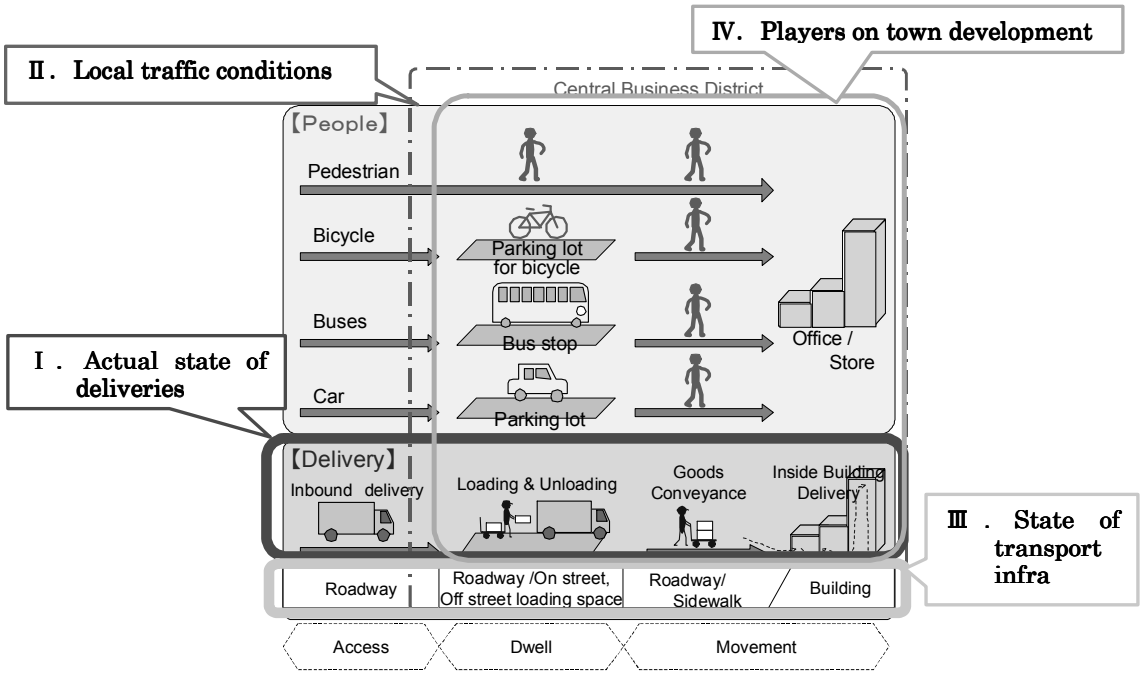
The increasing difficulty of accessing the CBD and moving about freely are frequent issues when it comes to discussing urban traffic problems. Figure 4 shows the relation between distribution and the traffic problem. Often cited as a cause of these problems are the deliveries which generate increased volumes of trucks that congest the flow of traffic, increased roadside parking, and increased back and forth movement from/to trucks for final goods conveyance. Because of this, it is necessary to identify the challenges that delivery activities pose to the community and to find ways to solve them.
To understand the delivery process to come up with measures on urban planning, it is necessary to collect vital data and to survey concerned districts with regards to the following (Refer to figure 5):

1) actual state of deliveries
2) local traffic conditions that have the biggest impact on the area
3) state of transportation infrastructure within the area, and
4) important players concerned with town planning and development.



Source: Guideline of delivery distribution on TRM(2006)

Figure 4. Relationship between deliveries and local issues



Source: Guideline of delivery distribution on TRM(2006)

Figure 5. Framework for understanding delivery activities

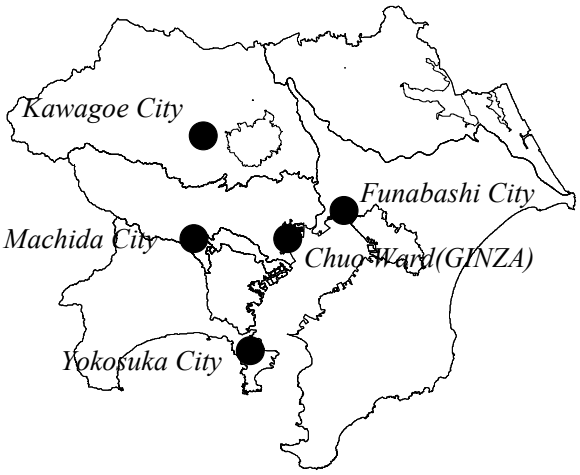
OVERVIEW OF THE LOCAL DELIVERY SURVEY IN THE TMR

The Tokyo Metropolitan Region (TMR) is a large CBD with numerous commercial districts in which deliveries must be made. Since it is costly and difficult to conduct the survey for each commercial establishment, a Local Delivery Survey was conducted for five districts within the TMR.

The selected five districts cover four prefectures out of the five prefectures and four major cities that constitute TMR's administrative bodies. The districts were not selected based on the size and characteristics of their CBD alone. Other various parameters, such as level of awareness of distribution-related problems, were also taken into account as part of the selection process.

Because most commercial districts in Japan are centered around rail stations, all the selected commercial districts were also located near rail stations. The field studies were conducted in the following districts (Refer to figure 6):

1) Tokyo: Chuo Ward, Ginza Area (one of the largest commercial areas in Japan)
2) Tokyo: Machida City (Tokyo suburb)
3) Chiba Prefecture: Funabashi City Central Business District (Tokyo suburb)
4) Kanagawa Prefecture: Yokosuka City Central Business District (port town)
5) Saitama Prefecture: Kawagoe City Central Business District (town which has preserved its traditional Japanese buildings and character)



Source: Guideline of delivery distribution on TRM(2006)

Figure 6. Location of the five selected districts

Based upon the framework discussed in the previous section, the following surveys in the five districts were conducted:

1. Survey of actual delivery conditions
    - Survey of local distribution conditions such as delivery truck parking locations and actual locations of pick-up/delivery of goods

2. Other transport modes and their effect on distribution
    - Actual traffic conditions and transport modes, and their impact on deliveries from the perspective of local urban and transport planning

3. Shopkeepers' and visitors' opinions on distribution
    - Pedestrians opinions on how to improve pedestrian movement and environment

4. Road infrastructure survey
    - Dimensions of parking spaces for delivery trucks
    - Traffic problems caused by deliveries varied accordingly based on the level of infrastructure

Table 1 details the type of surveys conducted in each district:

Table 1. Good Flow Survey content

	Survey Type	Main issues	Case study district				
			G	M	K	F	Y
Actual state of deliveries	1) Street parking survey	• Car type (vehicle make and model, etc.) • Parking location, parking start and finish time • Whether goods were unloaded or not • Parking conditions (double parking, in bus stops, etc) • Whether there was an effect on passing vehicles and pedestrians	○	○	○	○	○
	2) Follow-up study on goods conveyance from/to the delivery vehicle	• Car type (vehicle make and model, etc) • Parking location, parking start and finish time • Destination to/from where goods were carried (location, distance, type) • Entanglements with pedestrians during transport of goods • Reason of choosing parking location		○	○	○	○
	3) Questionnaires and interviews of business establishments in the area	• Business establishment attributes (type of business, products, operating hours, floor space) • Presence of parking lot for loading and unloading • Main delivery hours, number of units & goods weight • Special transport conditions • Possibility of time change, change in shipper • Opinions relating to problems in the area caused by deliveries			○	○	○
Local traffic condition	4) Survey on the amount of car traffic and number of pedestrians passing by	• Amount of automobile traffic according to time of day • Pedestrian volume according to time of day • Driving speeds for cars traveling along major roads • Number of pedestrians concentrated in designated locations and means or transportation	○	○	○	○	○
State of transport infra	5) Road space conditions (using maps, etc.)	• Road structure • Use of existing parking lot • Traffic regulation conditions • Future planning	○	○	○	○	○
Players on town development	6) Questionnaires and interviews with people in the delivery business	• Reasons for choosing parking space • Inclination for using delivery facilities (Joint delivery and joint loading/unloading facilities)	○	○	○		
	7) Questionnaires and interviews with bus employers and drivers	• Bus service situation • Bus use situation (number of rider, etc) • Driving difficulties			○		
	8) Questionnaires and interviews with people coming into town	• Attributes of people coming into town • Awareness of negative impact to pedestrian Environment caused by deliveries • Need for measures to deal with deliveries • Impressions of the district (reason for differences in image from district to district)		○	○		

Note: Case study district: G: Ginza, M: Machida, K: Kawagoe, F: Funabashi, Y: Yokosuka

Source: Guideline of delivery distribution on TRM(2006)

MAJOR DERIVERY ISSUES BASED ON THE SURVEYS

From the case study, it was revealed that delivery involves various characteristics. For example, figure 7 shows the share of parked vehicles in case study districts. The highest proportion of parked vehicles on the street belongs to delivery trucks occupying 70% of the total volume. But even in the district with the lowest proportion of delivery trucks, it still has a remarkably high share of 45%.

Likewise, from the questionnaire survey that was administered to commercial facilities, it was learned that only 10% of stores, including large scale commercial facilities, have their own loading and unloading parking spaces (figuer 8). The average time for delivery trucks to park on the street was 10 minutes. 32% of delivery trucks parked for less than 5 minutes and more than half parked for less than 10 minutes (figuer 9).

The conveyance distance from the delivery truck to the destination facility is found out to be about 30 meters. The delivery trucks tend to park as close as possible to their destination facilities.

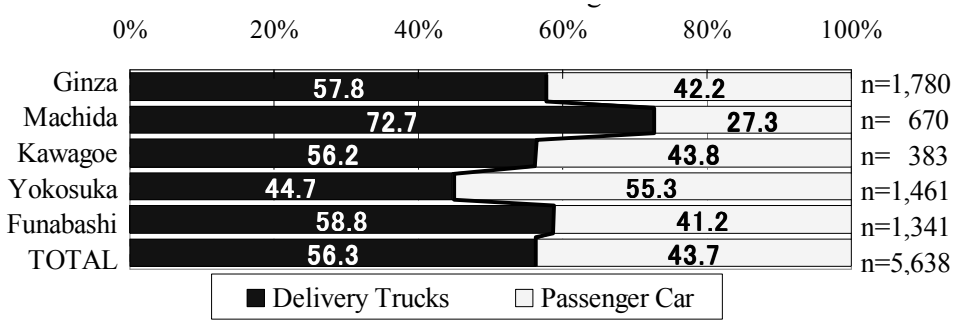


Figure 7. Share of parked vehicles

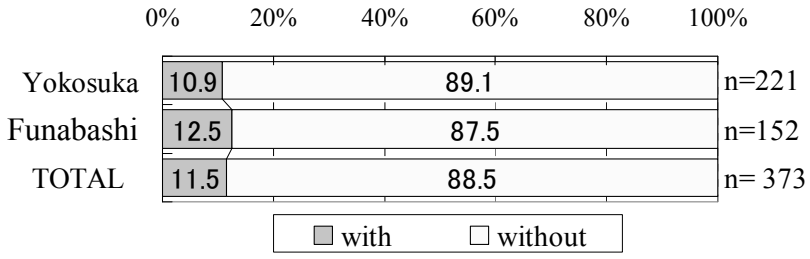
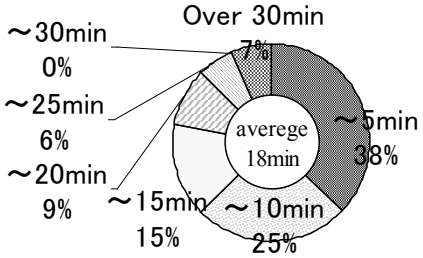


Figure 8. Stores with auxiliary spaces for loading and unloading



Source: Guideline of delivery distribution on TRM(2006)

Figure 9. Truck volume share according to parking duration

URBAN AND TRANSPORT PROBLEMS CAUSED BY DELIVERRIES

By analyzing the survey on deliveries conducted through the case studies in the five districts, the mechanism of how deliveries in the TMR causes local traffic problems can be grasp through quantitative data.

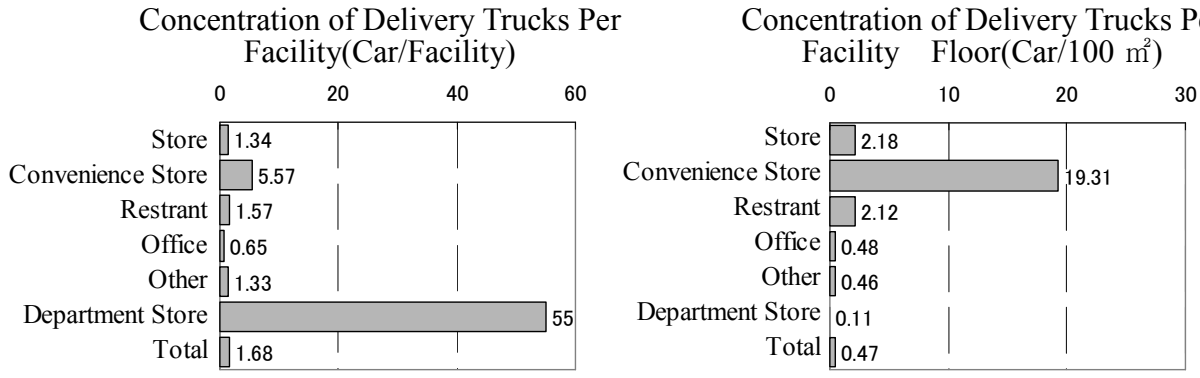
The major reasons behind this can be explained and organized as follows:

1) The extent to which problems arise due to the type of facility.

In Japan, a great number of department stores are located in the CBD, and which are usually adjacent to large train stations. In the case study areas, there were districts that have large department stores located in them.

Figure 10 shows a concentration of delivery trucks per facility and their corresponding space allocation. Because department stores have large floor areas, delivery trucks are highly concentrated around them. A large number of convenience stores are also located in the CBD. And because various products are being brought in and out of the convenience stores, the concentration of delivery trucks is relatively high for their corresponding floor spaces. Furthermore, most convenience stores located in the CBD do not have parking spaces for delivery trucks.

Department stores and convenience stores may be considered completely different types of facilities, but in the CBD where they mix together; there is a shortage of space for loading and unloading of goods. Hence, many of the delivery trucks that bring in goods to these stores are forced to park on the surrounding streets. As a result, traffic jams occur.



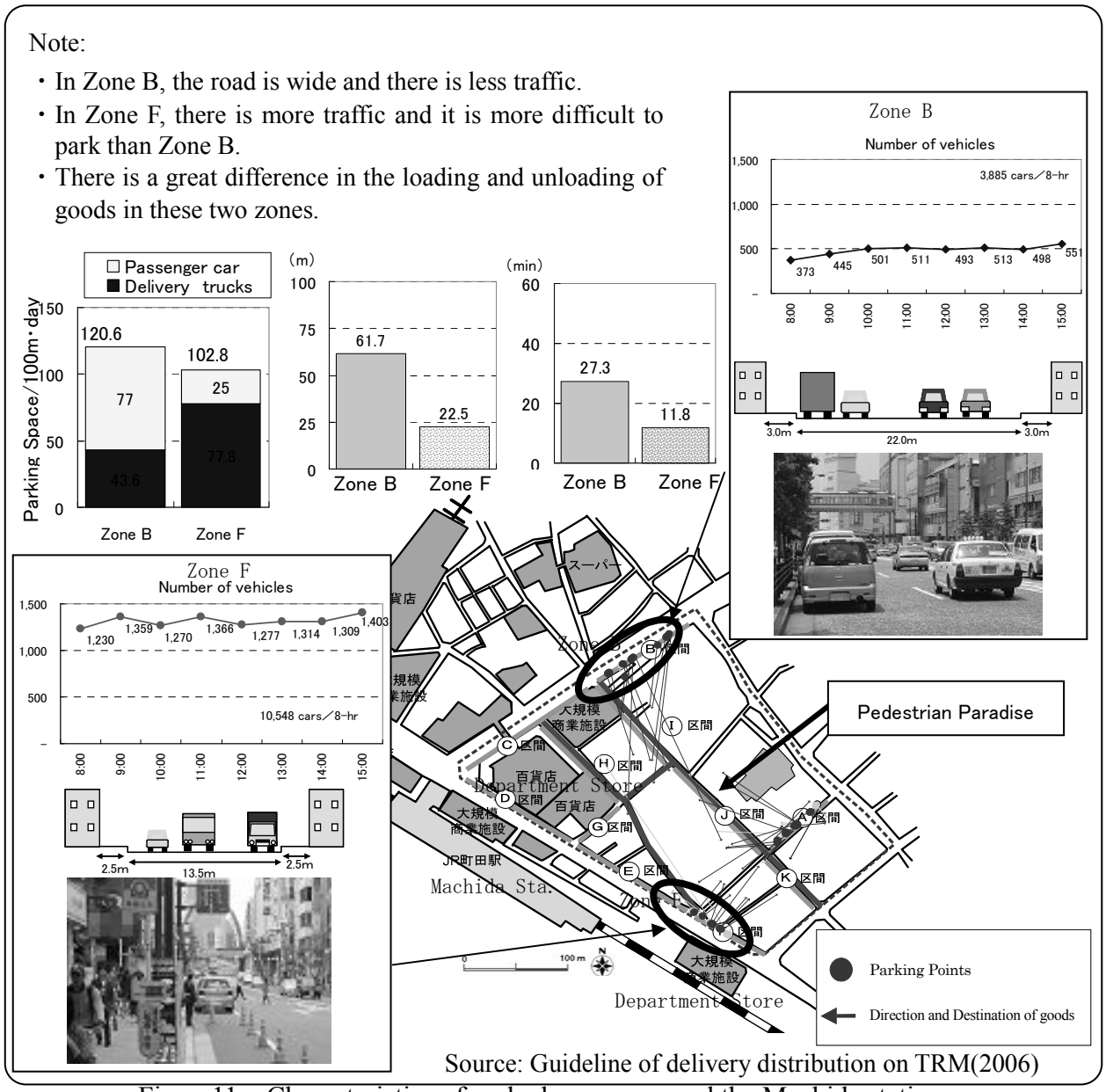
Source: Guideline of delivery distribution on TRM(2006)

Figure 10. Concentration of delivery trucks

2) Positional Relationship Between the Delivery Vehicle Parking Space and the Delivery Facility

Most delivery vehicles load and unload their goods after parking on the street. Hence, a major issue with regards to the spatial relationship between parking space and the delivery facility is whether the street, where most delivery trucks are parked, can provide safety or not.

Results from the surveys were analyzed paying close attention to the distance between the parking space and the delivery facility. The tendency was for both delivery truck parking time and distance between parking and destination facility to be shorter in places where traffic is greater and the streets were not wide enough.



Source: Guideline of delivery distribution on TRM(2006)

Figure11. Characteristics of parked spaces around the Machida station

Figure11 shows an actual parked space in Machida district. For example, two large roads surround the perimeter of Machida district. One of the roads has relatively more traffic, has a bus lane, and traffic enforcers are present to prevent illegal parking. On this road, most of the delivery trucks would load and unload their goods right in front of the facility and finish in an extremely short amount of time. The other road has less traffic and wider such that it causes little impact to the flow of traffic even if cars are parked on the road. On this street, goods were carried a longer distance to their destinations and delivery vehicles parked for long periods of time. The difference in parking times for these two places is more than fifteen minutes, and there is an almost 40 meter difference in the distance goods were carried from the delivery truck to its destination. This shows that with a secure place to park, deliveries took longer and goods were carried longer distances.

3) Effect of deliveries on pedestrians and other means of transportation (pedestrians, buses, passenger cars)

The field surveys also examined the effects of deliveries on pedestrians and other modes in an effort to improve transportation within the area taking into account the unique characteristics of the area.

Impediments to pedestrians caused by delivery vehicles parking on the street

- Visitors to the area felt that delivery vehicles entering the pedestrian mall had a negative impact on the pedestrian environment. (Figure 12)
- Although the pedestrian mall was not closed off to traffic until 11 a.m., the area was so popular that by 10 a.m., there were already about 1000 people passing through it every hour (Figure 13).
- On the other hand, because cars could not enter the area after 11 a.m., many delivery vehicles loaded and unloaded their goods before 11 a.m. However, some delivery vehicles continued loading and unloading operations and were suspected of having entered into the pedestrian mall area even before 11 a.m. (Figure 13). By impeding the movement of pedestrians these vehicles were considered to have compromised pedestrian mall's integrity.

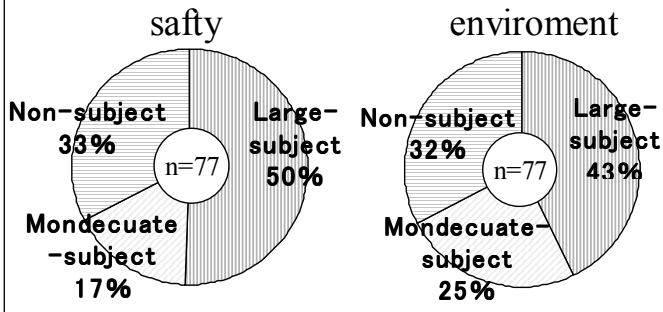


Figure 12. Issue of delivery trucks

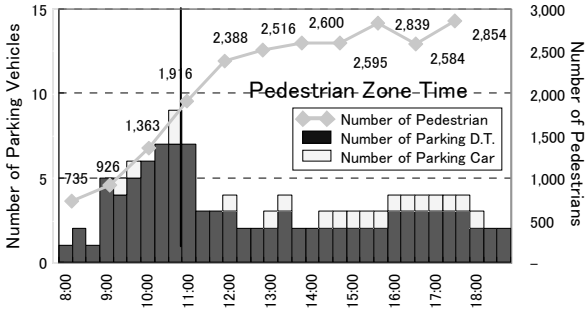


Figure 13. Hourly pedestrian volume and Number of parking delivery Trucks

Delivery truck in pedestrian-only zone

Source: Guideline of delivery distribution on TRM(2006)

For example, in Machida, the CBD has been converted into a pedestrian mall but delivery vehicles with a special permit are allowed to enter. As a result, delivery trucks drive through and park their vehicles in Machida's "pedestrian-only zone". The survey in the Machida district asked pedestrians who were in the mall to evaluate their feelings toward these delivery vehicles that were entering. The results showed that even though the number of delivery vehicles that entered the area was small, most pedestrians (75%) still did not like the idea of trucks mixing with people (Figure 12).

Because plans for increasing a district's appeal differed accordingly, it was clear that measures for improving deliveries would likewise be different.

MEASURES FOR DEALING WITH DELIVERIES IN THE TMR

According to the survey on deliveries conducted as part of the TMR's transportation plan; the implementation of measures dealing with deliveries will be essential in the future. Three things that should be addressed in planning for these measures are:

1) Plans should properly evaluate problems arising from deliveries
2) Plans should adopt suitable measures according to the type of problem
3) Plans should aim to build a consensus among the major concerned parties while putting these measures into practice.

A report, combining the results of the survey and ideas for dealing with deliveries was made public.

Through a quantitative analysis of the logistics survey, the structure of logistics problems in city planning was analyzed. The report said the measure together at each of three main activities referred relationship between deliveries and local issue (figure 4). It concluded by summarizing the various policies into the following three measures (figure 14):

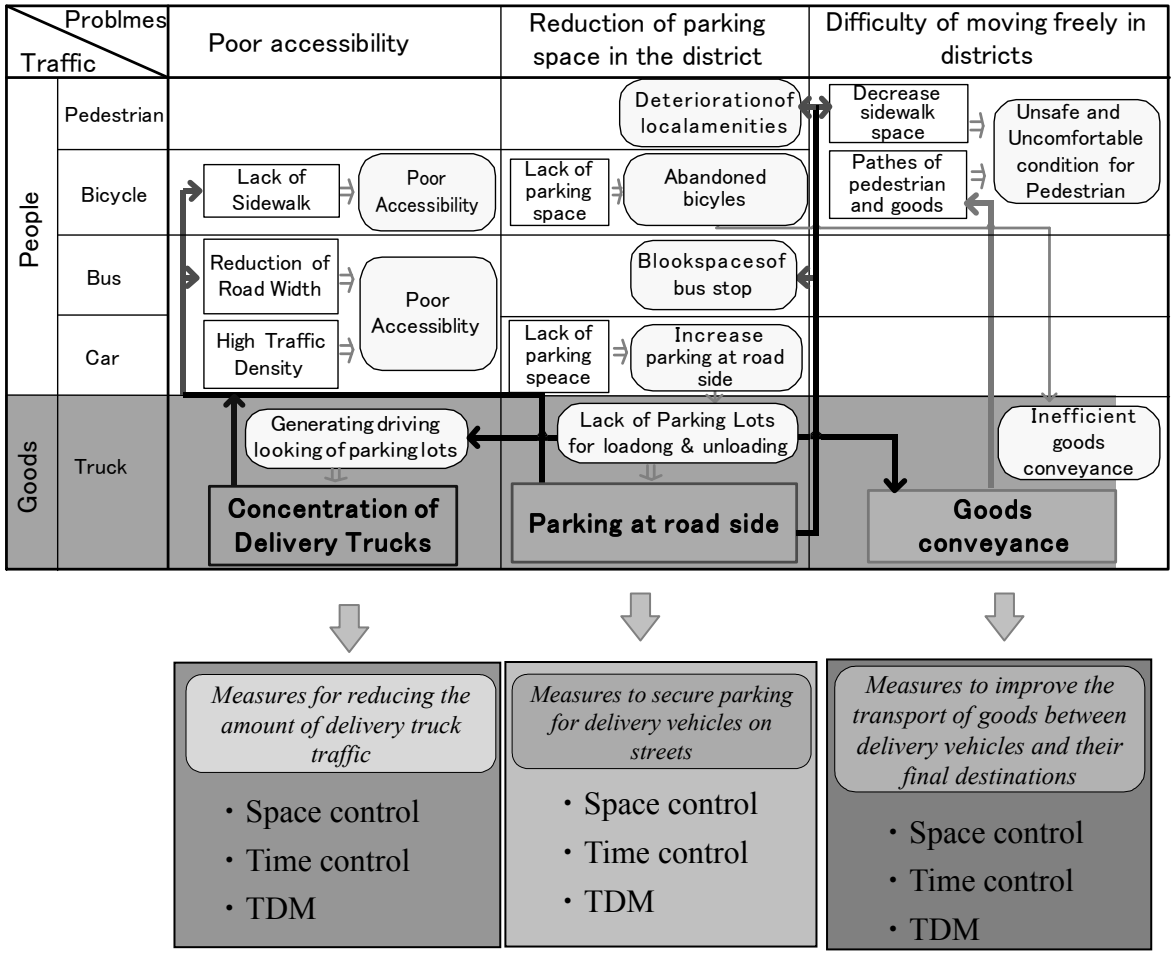
1) Measures to reduce the amount of delivery vehicle traffic.
- Consolidation, traffic inflow controls, etc.

2) Measures to secure parking for delivery vehicles on streets.
- Provision of parking spaces for loading and unloading
- Time-sharing between passenger cars and delivery vehicles

3) Measures to improve the transport of goods between delivery vehicles and their final destinations.
- Separation of goods and pedestrian movements, etc.

These measures intend to separate delivery traffic from other types of traffic, through the use of control and efficient management of space, time and other demand measures.

The report provides numerous options and recommendations on how to deal with the problems of deliveries. Furthermore, the measures were organized according to type of logistics-related problems faced by a particular area. In doing so, the report helps assist city planning officials in the selection of appropriate measures according to local characteristics.



Source: Guideline of delivery distribution on TRM(2006)

Figure 14. Types of measures for dealing with logistics problems in particular areas

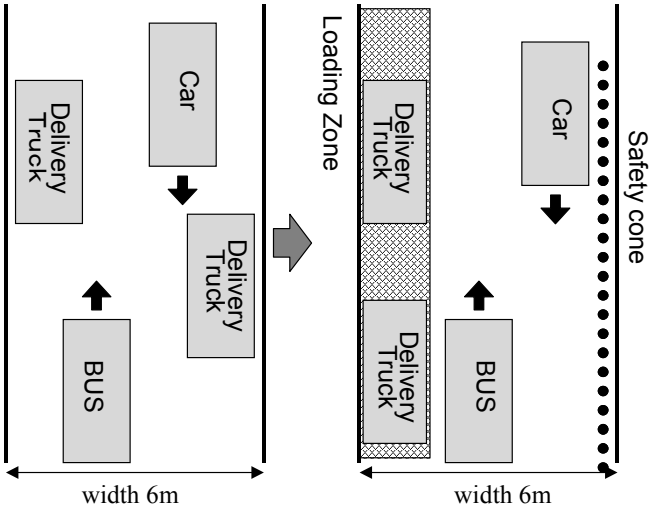
Typical Examples of Policies for Dealing With Deliveries

Figure 15, figure 16, figure 17 and figure 18 are example of measure to use of control and efficient management of space.

Figure 15,case of a, a comprehensive pilot program was undertaken in Tokyo's Shibuya-ward in order to alleviate traffic congestion in the area. By narrowing lane widths, new loading and unloading parking spaces were created on one side of the road. Figure16-17,case of b, it is also necessary to consider it to the size so that the delivery vehicle may use loading/unloading space.

a) Example of developing new parking spaces for delivery vehicles by changing the number of lanes and lane width (Shibuya-ward, Pilot program around Shibuya Station).

- A comprehensive pilot program was undertaken in Tokyo's Shibuya-ward in order to alleviate traffic congestion in the area.
- As a result of the policy, cars were able to travel faster and delivery trucks were able to park on the street in a more reasonable manner.
- Methods, which clearly proved to be effective through this trial, were put into effect throughout the city.



○Effect of Measures

Because there is enough spaces, trucks can now travel 8 km/h faster than before.

Figure 15. How road space was secured in Shibuya

Source: Guideline of delivery distribution on TRM(2006)

b) Promoting provision of obligatory loading areas as part of building redevelopment projects (e.g. Chiyoda-ward, New maru Building)

- Many older buildings in Japan have underground parking lots with ceilings which are too low for delivery vehicles to be able to enter.
- With the Maru building's reconstruction in 1999, paths and parking structures were made higher and broader enabling delivery vehicles to enter.

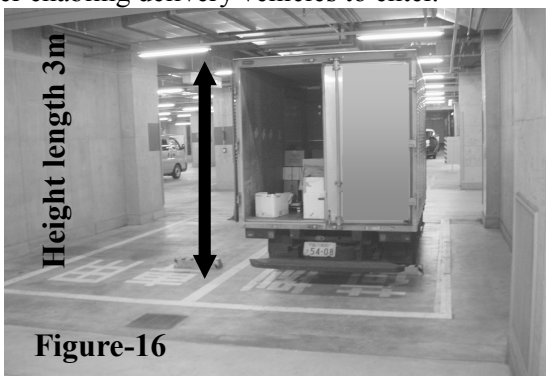


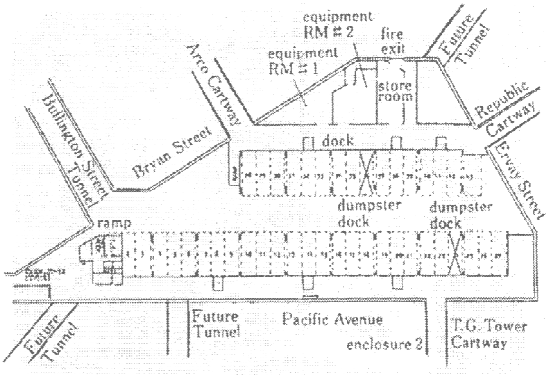
Figure 16. Example of loading space envisioned for 4-ton class delivery vehicle

Figure 17. Example of Building in Marunouchi area which has not provided adequate height

Source: Guideline of delivery distribution on TRM(2006)

c) Example of new route built exclusively for transporting goods from delivery trucks (e.g. Dallas, Texas, transport route connecting truck terminal located underground)

▪ In Dallas, goods for any of six adjacent buildings can be unloaded in the truck terminal built beneath the park (with a total floor space of approximately 50 ha). In Japan, this type of truck terminal is still rare.



Source: Guideline of delivery distribution on TRM(2006)

Figure 18. Passage between truck terminal and buildings

REMARKS

In Japan, very few cities take into account logistics aspects in urban and transport planning. However, measures to improve logistics are fundamental in most areas to enhance transport safety and local conditions and amenities.

The quantitative analysis of the survey clarifies the necessity of recommending measures to improve the procedure and conditions of local delivery. We shoe one method to recognize actual and problem of deliveries, using Tokyo Metropolitan Freight Survey. The deliveries were related with a various type of transportation in CBD so that it may be clear that there are relationships among three main activities.

Therefore, it is important to develop deliveries measure in corporation with the players in order to improve the urban traffic. When deliveries measures come to reality, we must consider a wide method of situation not only deliveries measures but also other planning, such as constructing building, constructing road, traffic control, etc.

And we very much appreciate that Dr.Jun Castro(in University of Philippine.) help us.

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